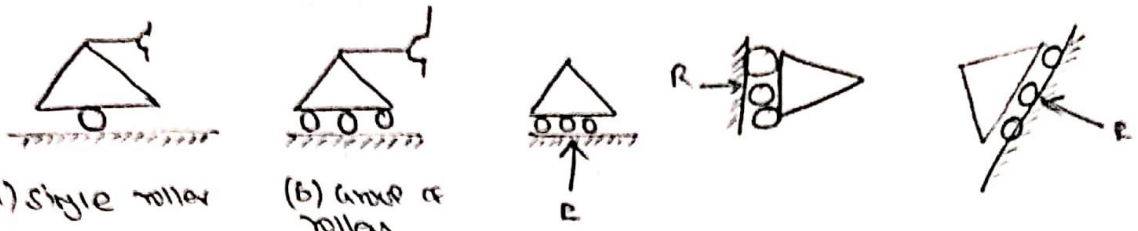
Types of Support. (48)

① Roller, ② Hinged ③ fixed.

1) Roller Support

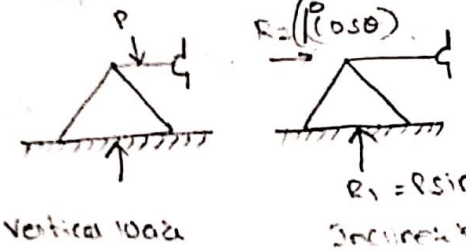


(a) Single roller (b) Group of rollers.

Roller support cannot withstand any force parallel to its own plane. The support will simply roll of it there is some parallel force to its plane.

Hence the roller support has only one reaction.

2) Hinged support.



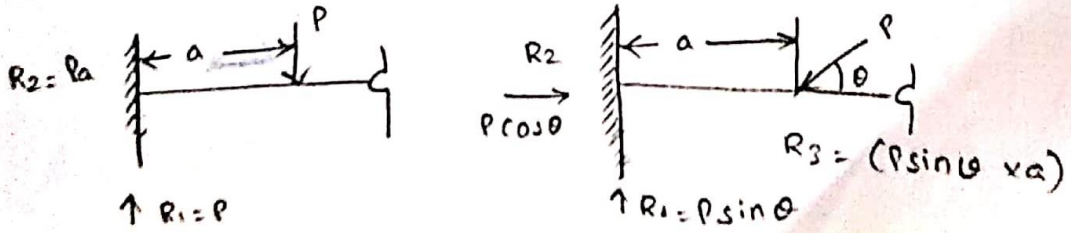
Hinged support can withstand any type of force both horizontal & vertical.

Hence it has two reaction components, vertical & horizontal

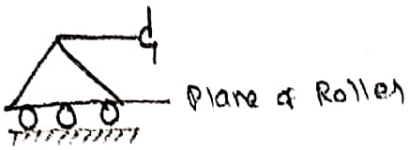
Hinged support is also called Pin-Joined support.

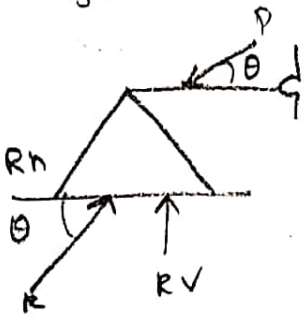
3) Fixed support:

Both Roller & Hinged support can resist only displacement ~~both~~ but rotation of beam is not resisted by both the supports. This can be given by the fixed support. Hence fixed support has three reaction components. horizontal, vertical & rotational reaction. Fixed support is considered as the strongest support.



Comparison between Roller & Hinged support.





$R = \sqrt{R_h^2 + R_v^2}$

$\theta = \tan^{-1}\left(\frac{R_V}{R_h}\right)$

Roller support has the known line of action of reaction is always normal to the plane of rollers but hinged support has an unknown line of action of reaction it any angle θ, with horizontal.

Types of loads:

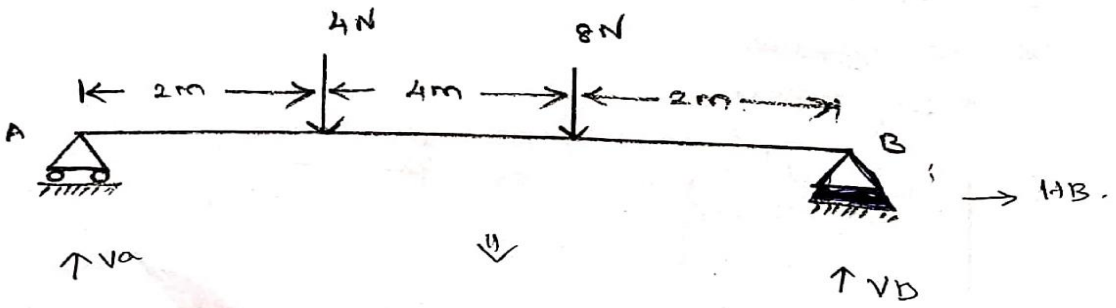
① Point load ② UDL ③ UVL

① In all the problems initially the magnitude & direction of support reaction are unknown. Hence their direction are assumed first as we want and the equilibrium equations are applied i-e $\Sigma H = 0$, $\Sigma V = 0$, $\Sigma m = 0$

② while solving if we get negative value it indicates that the assumed direction is wrong, hence reverse the direction.

Problem:

Finaate support reactions of SSS B as shown.



Note:

In all the Problems, vertical reactions are assumed upwards and the horizontal reactions are assumed, acting upwards from the support. While solving if we get negative value, direction has to be changed i.e opposite to the direction initially assumed.

Applying $\Sigma H = 0 \quad (\rightarrow +) \qquad H_B = 0$ (No, external force on beam)

" $\Sigma V = 0 \quad (\uparrow +) \qquad V_A + V_B - 4 - 8 = 0$

$$V_A + V_B = 12\,kN \quad \text{——} (1)$$

Now taking moment of all the forces about A, and equaty the zero

$$\Sigma m_A = 0$$

$$(4 \times 2) + (8 \times 6) - V_B \times 8 = 0$$

$$V_B = \frac{56}{8} = 7\,kN$$

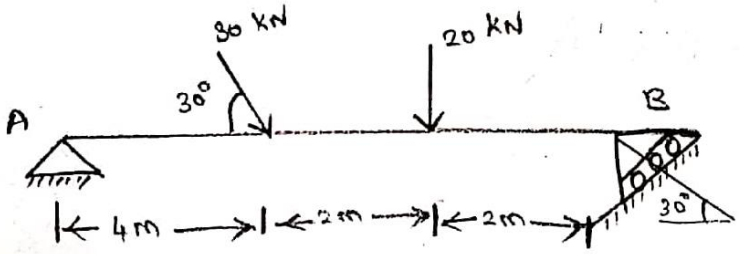
$$\therefore V_A = 12 - 7 = 5$$

Result:

$H_B = 0$, $V_A = 5\,kN \uparrow$, $V_B = 7\,kN \uparrow$

Problem

Determine the support reaction of the beam shown.



Applying $\Sigma H = 0$ ($\rightarrow +$)

$30 \cos 30° - HA - R_B^{(H_B)} \cos 30° = 0$ $\quad (H_B = R_B \cos 30°)$

$0.866 R_B + HA = 25.98$ ——— (1)

Apply $\Sigma V = 0$ ($\uparrow +$)

$VA + R_B^{(V_B)} \sin 30° - 30 \sin 30 - 20 = 0$ $\quad [V_B = R_B \sin 30°]$

$VA + 0.5 R_B = 35$ ——— (2)

Apply $\Sigma mA = 0$ ($\circlearrowleft +$)

$(30 \sin 30° \times 4) + (20 \times 6) - (V_B \times 8) = 0$

$(30 \sin 30° \times 4) + (20 \times 6) - (R_B \sin 30 \times 8) = 0.$

$R_B \sin 30° \times 8 = 180$

$\boxed{R_B = 45 \text{ KN}}$

Sub R_B value in eqn (1)

$0.866 R_B + HA = 25.98$

$\boxed{HA = -13 \text{KN}}$

HA with negative value means to consider the opposite direction

$\boxed{HA = 13 \text{ KN}}$

Substitute R_B value in eqn (2)

$VA + 0.5 R_B = 35$

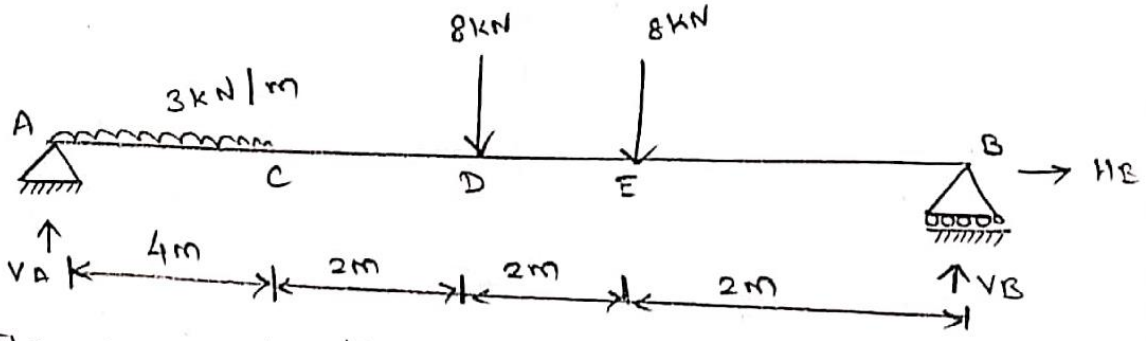
$\boxed{VA = 12.5 \text{ KN}}$

Result:

$HA = 13 \text{KN}$

$VA = 12.5 \text{ KN}.$

A Beam AB of 10m Span is loaded as shown in the fig. Determine the reaction at A & B.



The assumed direction of reaction or components are shown in fig.

For UDL $3 \times L = 12$ kN acting at midpoint or AC is at 2m from A

Applying $\Sigma H = 0$ $[H_A = 0]$

Applying $\Sigma V = 0$ $V_A + V_B - 12 - 8 - 8 = 0$

$V_A + V_B = 28$ ——— (1)

Applying $\Sigma m_A = 0$

$(12 \times 2) + (8 \times 6) + (8 \times 8) - V_B \times 10 = 0$

$24 + 48 + 64 - 10V_B = 0$

$V_B = 136/10$

$V_B = 13.6$ kN

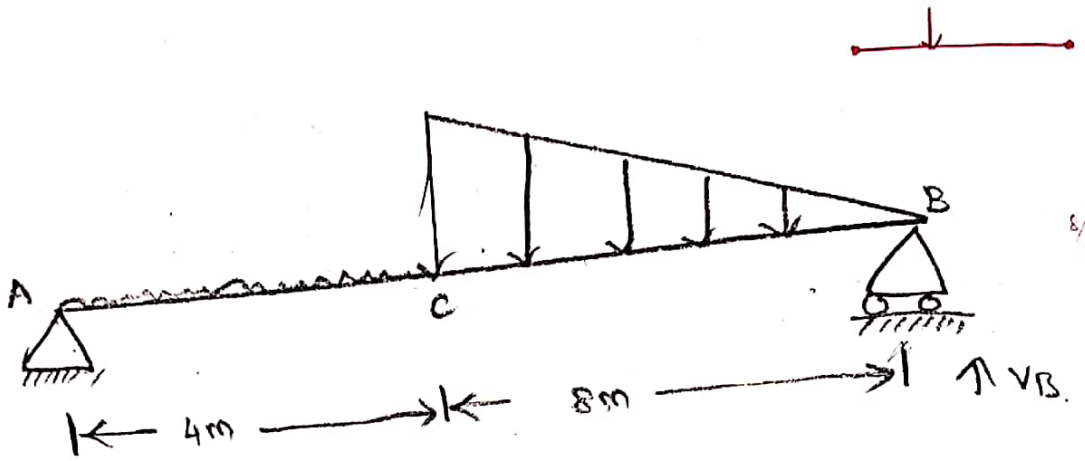
$V_A = 28 - 13.6$

$V_A = 14.4$ kN

Result:

$V_A = 14.4$ kN ; $V_B = 13.6$ kN

Calculate the support reactions of a SSB as shown in



the assumed direction of reaction is shown in fig.

Applying $\Sigma H = 0$ $\boxed{H_A = 0}$

Apply $\Sigma V = 0$ $V_A + V_B - 4 - 8 = 0$ $\therefore V_A + V_B = 12$ — (1)

Apply $\Sigma M_A = 0$

$(4 \times 2) + (8 \times 6.67) - V_B \times 12 = 0$

$\boxed{V_B = 5.11\ kN}$

Substitute V_B in (1) to get $V_A = 12 - 5.11 = 6.89\ kN$

Result:

$V_A = 6.89\ kN$

$V_B = 5.11\ kN$